Inferring the effects of sink strength on plant carbon balance processes from experimental measurements

Kashif Mahmud¹, Belinda E. Medlyn¹, Remko A. Duursma¹, Courtney Campany^{1,2}, Martin G. De Kauwe³

Supplementary Information

Supplementary Section S1: Time dependent parameters

Supplementary Table S1: BIC values from time dependent parameter fit. The lowest BIC values indicate the best performing parameter setting. Treatment groups are: 'Small' - 5 L, 10 L and 15 L containers; 'Large' - 20 L, 25 L and 25 L containers; 'Free' – freely rooted seedlings.

Supplementary material

S1. Time dependent parameters

This section tests the time-dependency of CBM parameters $(k, Y, a_f, a_w, a_r, s_f)$ due to ontogenetic or seasonal effects. We considered two alternative parameter sets to allow this variation from the default constant parameter setup with one set of parameters, *p* that does not change with time:

- a) Linear $(p = p_1 + p_2 * t)$: Two sets of parameters representing linear variation over time,
- b) Quadratic $(p = p_1 + p_2 * t + p_3 * t^2)$: Three sets of parameters that result in quadratic variation with time.

We examined whether parameters varied over time by comparing the BIC values for constant, linear, and quadratic parameter settings. The results are illustrated in Table S1 (Simulation Set D), which shows the effect of time dependency. Changing from constant to linear time-dependences improved BIC values for every treatment, indicating that there is significant variation over time in at least some parameters. Changing from linear to quadratic variation in parameter values also improved the goodness of fit, although to a smaller but significant extent. For example, with the optimum treatment grouping option (3 groups), BIC values indicate that the quadratic variation over time in parameters is the best option; BIC numbers are reduced by around 16%, 2% and 20% for small container, large container and free seedlings respectively from linear to quadratic parameter settings (Table S1). We also tested 3rd degree polynomial

equations for parameter variation (not shown), but it increased model complexity without improving the fit.

Table S1: BIC values from time dependent parameter fit. The lowest BIC values indicate the best performing parameter setting. Treatment groups are: 'Small' - 5 L, 10 L and 15 L containers; 'Large' - 20 L, 25 L and 25 L containers; 'Free' – freely rooted seedlings.

| Simulation set | Model settings | Treatment groups | BIC |
|----------------|-------------------------------|------------------|------|
| D | Constant parameter variation | Small | 1391 |
| | | Large | 646 |
| | | free | 332 |
| | Linear parameter variation | Small | 826 |
| | | Large | 462 |
| | | free | 217 |
| | Quadratic parameter variation | Small | 683 |
| | | Large | 457 |
| | | free | 170 |